

APPENDIX F.1: PRELIMINARY REMEDIAL GOALS FOR PCBs AND ARSENIC: BASELINE RECEPTORS

Amtrak Wilmington Former Facility

Adult Trespasser

Variable	Value
TR (target cancer risk) unitless	1.0E-5
THQ (target hazard quotient) unitless	1
AT _{ow} (averaging time - outdoor worker)	365
EF _{ow} (exposure frequency - outdoor worker) day/yr	10
ED _{ow} (exposure duration - outdoor worker) yr	12
ET _{ow} (exposure time - outdoor worker) hr	2
LT (lifetime) yr	70
BW _{ow} (body weight - outdoor worker)	80
IR _{ow} (soil ingestion rate - outdoor worker) mg/day	100
SA _{ow} (surface area - outdoor worker) cm ⁻² /day	6032
AF _{ow} (skin adherence factor - outdoor worker) mg/cm ⁻²	0.3
City _{PEF} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{wp} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
PEF (particulate emission factor) m ⁻³ /kg	3232997753.610999
A (PEF Dispersion Constant)	14.0111
B (PEF Dispersion Constant)	19.6154
C (PEF Dispersion Constant)	225.3397
V (fraction of vegetative cover) unitless	0.5
U _m (mean annual wind speed) m/s	4.29
U _t (equivalent threshold value)	11.32
F(x) (function dependant on U _m /U _t) unitless	0.0993
City _{ve} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
foc (fraction organic carbon in soil) g/g	0.006
p _b (dry soil bulk density) g/cm ³	1.5
p _s (soil particle density) g/cm ³	2.65
n (total soil porosity) L _{poro} /L _{soil}	0.43396
a (air-filled soil porosity) L _{air} /L _{soil}	0.28396

Site-Specific Outdoor Worker Equation Inputs for Soil

Variable	Value
ω (water-filled soil porosity) $L_{\text{water}}/L_{\text{soil}}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	14.0111
B (VF Dispersion Constant)	19.6154
C (VF Dispersion Constant)	225.3397
City $\nu F_{\text{massloading}}$ (Climate Zone) Selection	Philadelphia, PA (8)
VF_{ml} (volitization factor - mass-limit) m ⁻³ /kg	0
Q/C _{voi} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
A _c (acres)	.5
T (exposure interval) yr	26
d _c (depth of source) m	.
p _b (dry soil bulk density) g/cm ³	1.5
A (VF Dispersion Constant - Mass Limit)	14.0111
B (VF Dispersion Constant - Mass Limit)	19.6154
C (VF Dispersion Constant - Mass Limit)	225.3397

Site-Specific

Outdoor Worker PRG for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),

ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,

Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),

Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	Chronic	RfD	Chronic	RfC (mg/m ³)	Chronic	RfC Ref	Ingestion SF (mg/kg-day) ⁻¹	SFO Ref	Inhalation Unit Risk (ug/m ³) ⁻¹	IUR Ref	Inhalation ABS _{derm}	Volatilization Factor (m ³ /kg)	K _d (cm ³ /g)
				RfD	Ref	RfC	Ref	RfC	Ref	Unit Risk	IUR Ref	ABS _{derm}	ABS _{gi}	Factor (m ³ /kg)	K _d (cm ³ /g)	
Arsenic, Inorganic	No	No	3.00E-04	I	1.50E-05	C	1.50E+00	I	4.30E-03	I	0.03	1	-	-	29	
Polychlorinated Biphenyls (high risk)	No	Yes	-	-	-	-	2.00E+00	I	5.71E-04	I	0.14	1	6.81E+05	-	468.6	

K _{oc} (cm ³ /g)	Particulate Emission Factor (m ³ /kg)	Soil Saturation Concentration (mg/kg)	Solubility (mg/L)	RBA	Ingestion PRG TR=1.0E-5 (mg/kg)	Inhalation PRG TR=1.0E-5 (mg/kg)	Dermal PRG TR=1.0E-5 (mg/kg)	Carcinogenic PRG TR=1.0E-5 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
-	3.23E+09	-	-	0.6	1.89E+03	1.92E+07	2.09E+03	9.94E+02	1.46E+04	2.12E+07	1.61E+04	7.66E+03
7.81E+04	3.23E+09	-	0.7	1	8.52E+02	3.05E+04	3.36E+02	2.39E+02	-	-	-	-

Amtrak Wilmington Former Fueling Facility

Youth Trespasser

Variable	Value
TR (target cancer risk) unitless	1.0E-5
THQ (target hazard quotient) unitless	1
AT _{ow} (averaging time - outdoor worker)	365
EF _{ow} (exposure frequency - outdoor worker) day/yr	10
ED _{ow} (exposure duration - outdoor worker) yr	7
ET _{ow} (exposure time - outdoor worker) hr	2
LT (lifetime) yr	70
BW _{ow} (body weight - outdoor worker)	57
IR _{ow} (soil ingestion rate - outdoor worker) mg/day	100
SA _{ow} (surface area - outdoor worker) cm ⁻² /day	4600
AF _{ow} (skin adherence factor - outdoor worker) mg/cm ⁻²	0.3
City _{PEF} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{wp} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
PEF (particulate emission factor) m ⁻³ /kg	3232997753.610999
A (PEF Dispersion Constant)	14.0111
B (PEF Dispersion Constant)	19.6154
C (PEF Dispersion Constant)	225.3397
V (fraction of vegetative cover) unitless	0.5
U _m (mean annual wind speed) m/s	4.29
U _t (equivalent threshold value)	11.32
F(x) (function dependant on U _m /U _t) unitless	0.0993
City _{ve} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
foc (fraction organic carbon in soil) g/g	0.006
p _b (dry soil bulk density) g/cm ³	1.5
p _s (soil particle density) g/cm ³	2.65
n (total soil porosity) L _{poro} /L _{soil}	0.43396
a (air-filled soil porosity) L _{air} /L _{soil}	0.28396

Site-Specific Outdoor Worker Equation Inputs for Soil

Variable	Value
ω (water-filled soil porosity) $L_{\text{water}}/L_{\text{soil}}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	14.0111
B (VF Dispersion Constant)	19.6154
C (VF Dispersion Constant)	225.3397
City (νF mass-loading) Selection	Philadelphia, PA (8)
νF_{ml} (volitization factor - mass-limit) m ⁻³ /kg	0
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² -s per kg/m ³	87.36897721623086
A _c (acres)	.5
T (exposure interval) yr	26
d _c (depth of source) m	.
p _b (dry soil bulk density) g/cm ³	1.5
A (VF Dispersion Constant - Mass Limit)	14.0111
B (VF Dispersion Constant - Mass Limit)	19.6154
C (VF Dispersion Constant - Mass Limit)	225.3397

Site-Specific

Outdoor Worker PRG for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),

ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,

Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),

Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	Chronic	RfD	Chronic	RfC (mg/m ³)	Chronic	RfC Ref	Ingestion SF (mg/kg-day) ⁻¹	SFO Ref	Inhalation Unit Risk (ug/m ³) ⁻¹	IUR Ref	Inhalation ABS _{derm}	Volatilization Factor (m ³ /kg)	K _d (cm ³ /g)
				RfD	Ref	RfC	Ref	RfC	Ref	Unit Risk	IUR Ref	ABS _{derm}	ABS _{gi}	Factor (m ³ /kg)	K _d (cm ³ /g)	
Arsenic, Inorganic	No	No	3.00E-04	I	1.50E-05	C	1.50E+00	I	4.30E-03	I	0.03	1	-	-	29	
Polychlorinated Biphenyls (high risk)	No	Yes	-	-	-	-	2.00E+00	I	5.71E-04	I	0.14	1	6.81E+05	-	468.6	

K _{oc} (cm ³ /g)	Particulate Emission Factor (m ³ /kg)	Soil Saturation Concentration (mg/kg)	Solubility (mg/L)	RBA	Ingestion PRG TR=1.0E-5 (mg/kg)	Inhalation PRG TR=1.0E-5 (mg/kg)	Dermal PRG TR=1.0E-5 (mg/kg)	Carcinogenic PRG TR=1.0E-5 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
-	3.23E+09	-	-	0.6	2.31E+03	3.29E+07	3.35E+03	1.37E+03	1.04E+04	2.12E+07	1.51E+04	6.15E+03
7.81E+04	3.23E+09	-	0.7	1	1.04E+03	5.22E+04	5.38E+02	3.52E+02	-	-	-	-

Amtrak Wilmington Former Fueling Facility

RME Outdoor Worker

Variable	Value
TR (target cancer risk) unitless	1.0E-5
THQ (target hazard quotient) unitless	1
AT _{ow} (averaging time - outdoor worker)	365
EF _{ow} (exposure frequency - outdoor worker) day/yr	225
ED _{ow} (exposure duration - outdoor worker) yr	25
ET _{ow} (exposure time - outdoor worker) hr	8
LT (lifetime) yr	70
BW _{ow} (body weight - outdoor worker)	80
IR _{ow} (soil ingestion rate - outdoor worker) mg/day	100
SA _{ow} (surface area - outdoor worker) cm ⁻² /day	3527
AF _{ow} (skin adherence factor - outdoor worker) mg/cm ⁻²	0.12
City _{PEF} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{wp} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
PEF (particulate emission factor) m ⁻³ /kg	3232997753.610999
A (PEF Dispersion Constant)	14.0111
B (PEF Dispersion Constant)	19.6154
C (PEF Dispersion Constant)	225.3397
V (fraction of vegetative cover) unitless	0.5
U _m (mean annual wind speed) m/s	4.29
U _t (equivalent threshold value)	11.32
F(x) (function dependant on U _m /U _t) unitless	0.0993
City _{ve} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
foc (fraction organic carbon in soil) g/g	0.006
p _b (dry soil bulk density) g/cm ³	1.5
p _s (soil particle density) g/cm ³	2.65
n (total soil porosity) L _{poro} /L _{soil}	0.43396
a (air-filled soil porosity) L _{air} /L _{soil}	0.28396

Site-Specific Outdoor Worker Equation Inputs for Soil

Variable	Value
ω (water-filled soil porosity) $L_{\text{water}}/L_{\text{soil}}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	14.0111
B (VF Dispersion Constant)	19.6154
C (VF Dispersion Constant)	225.3397
City $\nu F_{\text{massloading}}$ (Climate Zone) Selection	Philadelphia, PA (8)
VF_{ml} (volitization factor - mass-limit) m ⁻³ /kg	0
Q/C _{voi} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
A _c (acres)	.5
T (exposure interval) yr	26
d _c (depth of source) m	.
p _b (dry soil bulk density) g/cm ³	1.5
A (VF Dispersion Constant - Mass Limit)	14.0111
B (VF Dispersion Constant - Mass Limit)	19.6154
C (VF Dispersion Constant - Mass Limit)	225.3397

Site-Specific

Outdoor Worker PRG for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),

ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,

Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),

Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	Chronic	RfD	Chronic	RfC (mg/m ³)	Chronic	RfC Ref	Ingestion SF (mg/kg-day) ⁻¹	SFO Ref	Inhalation Unit Risk (ug/m ³) ⁻¹	IUR Ref	Inhalation ABS _{derm}	Volatilization Factor (m ³ /kg)	K _d (cm ³ /g)
				RfD	Ref	RfC	Ref	RfC	Ref	Unit Risk	IUR Ref	ABS _{derm}	ABS _{gi}	Factor (m ³ /kg)		
Arsenic, Inorganic	No	No	3.00E-04	I	1.50E-05	C	1.50E+00	I	4.30E-03	I	0.03	1	-	-	29	
Polychlorinated Biphenyls (high risk)	No	Yes	-	-	-	-	2.00E+00	I	5.71E-04	I	0.14	1	6.81E+05	-	468.6	

K _{oc} (cm ³ /g)	Particulate Emission Factor (m ³ /kg)	Soil Saturation Concentration (mg/kg)	Solubility (mg/L)	RBA	Ingestion PRG TR=1.0E-5 (mg/kg)	Inhalation PRG TR=1.0E-5 (mg/kg)	Dermal PRG TR=1.0E-5 (mg/kg)	Carcinogenic PRG TR=1.0E-5 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
-	3.23E+09	-	-	0.6	4.04E+01	1.02E+05	1.91E+02	3.33E+01	6.49E+02	2.36E+05	3.07E+03	5.34E+02
7.81E+04	3.23E+09	-	0.7	1	1.82E+01	1.62E+02	3.07E+01	1.07E+01	-	-	-	-

Amtrak Wilmington Former Fueling Facility RME Excavation Worker

Variable	Value
TR (target cancer risk) unitless	1.0E-5
THQ (target hazard quotient) unitless	1
AT _{ew} (averaging time - excavation worker)	365
EF _{ew} (exposure frequency - excavation worker) day/yr	20
ED _{ew} (exposure duration - excavation worker) yr	1
ET _{ew} (exposure time - excavation worker) hr	8
LT (lifetime) yr	70
BW _{ew} (body weight - excavation worker) kg	80
IR _{ew} (soil ingestion rate - excavation worker) mg/day	330
SA _{ew} (surface area - excavation worker) cm ⁻² /day	3527
AF _{ew} (skin adherence factor - excavation worker) mg/cm ⁻²	0.3
City _{PEF} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{wp} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
PEF (particulate emission factor) m ⁻³ /kg	3232997753.610999
A (PEF Dispersion Constant)	14.0111
B (PEF Dispersion Constant)	19.6154
C (PEF Dispersion Constant)	225.3397
V (fraction of vegetative cover) unitless	0.5
U _m (mean annual wind speed) m/s	4.29
U _t (equivalent threshold value)	11.32
F(x) (function dependant on U _m /U _t) unitless	0.0993
City _{ve} (Climate Zone) Selection	Philadelphia, PA (8)
A _c (acres)	.5
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
foc (fraction organic carbon in soil) g/g	0.006
p _b (dry soil bulk density) g/cm ³	1.5
p _s (soil particle density) g/cm ³	2.65
n (total soil porosity) L _{poro} /L _{soil}	0.43396
a (air-filled soil porosity) L _{air} /L _{soil}	0.28396

Site-Specific

Excavation Worker Equation Inputs for Soil

Variable	Value
ω (water-filled soil porosity) $L_{\text{water}}/L_{\text{soil}}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	14.0111
B (VF Dispersion Constant)	19.6154
C (VF Dispersion Constant)	225.3397
City $\nu F_{\text{massloading}}$ (Climate Zone) Selection	Philadelphia, PA (8)
VF_{ml} (volitization factor - mass-limit) m ⁻³ /kg	0
Q/C _{vo} (inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source) g/m ² s per kg/m ³	87.36897721623086
A _c (acres)	.5
T (exposure interval) yr	26
d _c (depth of source) m	.
p _b (dry soil bulk density) g/cm ³	1.5
A (VF Dispersion Constant - Mass Limit)	14.0111
B (VF Dispersion Constant - Mass Limit)	19.6154
C (VF Dispersion Constant - Mass Limit)	225.3397

Site-Specific

Excavation Worker PRG for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),

ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,

Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),

Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	Mutagen?	VOC?	Subchronic RfD (mg/kg-day)	Subchronic		Subchronic RfC (mg/m ³)	Subchronic RfC Ref	Ingestion SF (mg/kg-day) ⁻¹	SFO Ref
				RfD Ref	Ref				
Arsenic, Inorganic	No	No	5.00E-03	P	1.50E-05	C	1.50E+00	I	
Polychlorinated Biphenyls (high risk)	No	Yes	-	-	-	-	2.00E+00	I	

Inhalation Unit Risk (ug/m ³) ⁻¹	IUR Ref	ABS _{derm}	ABS _{gi}	Volatilization Factor (m ³ /kg)	K _d (cm ³ >3</sup>/g)	K _{oc} (cm ³ /g)	Particulate Emission Factor (m ³ /kg)	Soil Saturation Concentration (mg/kg)	Solubility (mg/L)
4.30E-03	I	0.03	1	-	29	-	3.23E+09	-	-
5.71E-04	I	0.14	1	6.81E+05	468.6	7.81E+04	3.23E+09	-	0.7

Ingestion PRG TR=1.0E-5 RBA (mg/kg)	Inhalation PRG TR=1.0E-5 (mg/kg)	Dermal PRG TR=1.0E-5 (mg/kg)	Carcinogenic PRG TR=1.0E-5 (mg/kg)	Ingestion PRG HQ=1 (mg/kg)	Inhalation PRG HQ=1 (mg/kg)	Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic PRG HI=1 (mg/kg)
0.6 3.44E+03	2.88E+07	2.15E+04	2.97E+03	3.69E+04	2.66E+06	2.30E+05	3.14E+04
1 1.55E+03	4.57E+04	3.45E+03	1.04E+03	-	-	-	-